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ABSTRACT

This guide is designed to be used in either of two ways: (1) as a complete interdisciplinary science unit particularly useful in California: and (2) in combination with other documents, as a preparatory guide for field trips. The guide contains planning and teaching concepts generalizeable to most areas. Included are: (1) an introduction, (2) pre-trip lessons, (3) a field trip, (4) tests and evaluation, and (5) related information and references. (RE)

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# STEPPING OUTDOORS
# TEACHER'S GUIDE
# PART I
# Natural and Social Sciences for Understanding Our World

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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March 1980
State of California — The Resources Agency
DEPARTMENT OF PARKS & RECREATION

# TEACHER'S GUIDE

# PART I

# STEPPING OUTDOORS

## Natural and Social Sciences For Understanding Our World

March 1980

By Richard L. Swanson, Ph.D.

An environmental education publication of the California Department of Parks and Recreation, designed to help teachers use state parks and other outdoor locations as teaching tools for the required natural and social science curriculum.

**Edmund G. Brown Jr.**
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*Secretary for Resources*

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STATE OF CALIFORNIA—THE RESOURCES AGENCY EDMUND G. BROWN JR., Governor

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Dear Teacher,

This teacher's guide is intended for the elementary teacher who wishes to use the environment to teach about the environment. The book was designed by a teacher for teachers. It is the final result of a two-year curriculum design process based on the original model program at Morro Bay. It is intended for the teacher who wants to use the outdoors as a teaching tool, but may not know how or where to start.

This book is the starting place. It provides all the data, teaching ideas, and materials to prepare the students and the teacher for a successful environmental education experience.

The book can be used in either of two ways. First, by itself it is a complete interdisciplinary science studies unit that can be used anywhere in California, on any kind of outdoor field trip. The book was designed around the 5th and 6th grade California course of study and can be substituted for a week or more of study in science and social studies.

In combination with two other volumes, this book can prepare the teacher and class for a field trip to particular California state parks. Certain strategic parks in the system have a specific curriculum designed around this educational unit. Their curriculum includes these volumes: (1) this book and its pre- and post-visit activities, (2) a set of learning activities and ideas for the specific park, and (3) a reference-data book about the park, designed for use by both the students and the teacher.

Both in its single-volume form and as a three-volume package, this curriculum is an extremely powerful tool for teaching about ecology, adaptation, and environmental issues.

We hope you enjoy using it, and look forward to seeing you and your class at a state park in the near future.

Sincerely,

Russell W. Cahill

Russell W. Cahill
Director

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*Acknowledgments*

I wish to express my gratitude to all those people who helped make this revised edition possible. First, I wish to again thank Dart Industries and the California State Parks Foundation for their support of the initial pilot project which was the basis for this volume and accompanying guides for Morro Bay area state parks. I am particularly indebted to those teachers and administrators who participated in the evaluation of the original work for their fine contributions and careful testing of the materials.

As with the first edition, Dr. Robert Hoover was kind enough to provide information and review the materials as well as participate in the workshops that were a part of the curriculum improvement effort. This effort has made this volume a stronger teaching tool.

I also want to thank Paul Jilson of the office of the Santa Barbara County Superintendent of Schools for his fine cooperation; State Park Ranger Steve Johnson for a wonderful effort in coordination and planning; elementary teacher Jane Haskell, an advisor from the very start; Mary Lowe, graphic artist, and Jeff Cohen, editor, of the State Department of Parks and Recreation; and, of course, my wife Constance.

Preparation and publication of this revised edition was funded from the State's Environmental Protection Fund, derived from the purchase of personalized license plates.

*Richard L. Swanson*

# I
# INTRODUCTION

## The Instructional Unit Emphasis

This environmental unit has been designed to give you, the teacher, the tools and ideas to develop enough understanding in the students so their field trip will be a highly successful outdoor experience.

Three learning areas are emphasized in the unit:

1. The concepts of interdependency and adaptation are presented.

2. Inquiry skills are developed and utilized throughout the unit – observing, classifying, comparing and contrasting, generalizing, inferring, analyzing, hypothesizing, predicting, and verifying the human environment.

3. Attitudes and values are presented, as well as their relationships to environmental quality and environmental decisions.

The approach is interdisciplinary. Anthropology, psychology, biology, ecology, and geography are all included. Understanding the environment from several perspectives provides the student with the most appropriate view of the complexity of the environment.

## The Lesson Plans

The lessons in this book are designed to be used in any outdoor location. In case you choose a state park, you can request additional information to assist you in making your lesson plans more specific. Particular areas of the State Park System have companion volumes to this book, giving detailed information on field trip activities and land, life, and culture of the parks. (For information on this program, contact the Information Office, Department of Parks and Recreation, (916) 445-4624, or write P.O. Box 2390, Sacramento 95811.)

In this book, there are eight lessons for preparing for the field trip and two follow-up lessons. The eight preparatory lessons need not necessarily be given on eight different school days. You are the best judge of your own class. To add emphasis, it might be very advantageous to extend the lesson. These objectives may be considered too specific by some and too general by others. Therefore, feel free to modify the objectives to fit your needs.

When a lesson calls for a discussion, the lesson plan includes guiding questions to encourage it. The questions are given so that you will have something with which to guide the discussions as well as something to fall back on should you run out of your own questions.

Use this checklist to prepare for the lesson:

Read the whole program well in advance.

Order films several weeks in advance of when you need them. Lists of films and supplemental materials are located at the back of this book. Use them to augment lesson plans and to provide a wider range of media for students.

Read each lesson plan at least one day before you intend to use it.

Make up dittos and assemble materials needed for the lesson.

Review all discussion questions and allow ample time for discussions.

## Evaluation

Several discussions and activities are designed to provide the teacher with assessments of student progress and feedback for improving the instructional unit itself.

There is a ready-made test (see page 47) for students which should be given before you start the preparatory lessons. The same test will be given after the field trip, affording a means of judging your effectiveness as a teacher as well as determining improvement among individual students. Make sure students understand that this test will not affect their final grade in the unit.

The student certificate on the next page can be signed by a ranger-naturalist while you are at a state park. This certificate can be made into a ditto master by using a thermo-fax machine, and duplicated for each student.

# Environmental Education Certificate

This is to certify that

_____
(student's name)

as a member of _____
(teacher's name)

_____ grade class has completed the Environmental Education study at

_____

II

# PRE-TRIP LESSONS

## GETTING STARTED

*Introduction*

Before the field trip, obtain information about the state park unit or other location you are going to visit. (Companion volumes in this series can be used.)

Draw on the board a map of the place you are going to visit. You could also make a map on butcher paper or use a transparency with an overhead projector.

*Goal:* To introduce the instructional unit to the students, and to assess their level of knowledge about the place they will visit.

*Objective:* Students will talk or write about what they expect from the trip.

*Lesson*

**Materials Needed**: None

**Activities**: Mention the place or places you will be visiting. Point to each area you intend to visit and explain a little about the land around it.

*Ask:*

What do you think would grow in this area?

Why do you suppose this place was chosen to be a state park (or other (facility) in the first place?

What do you think you might learn by taking a trip there?

*Try to draw out as much information as you can from the students:*

What they know about state parks (or other outdoor areas) in general.

What they know about this area.

What they would like to learn on the field trip.

What they know about the area's history.

The answers to these questions will give you some idea of what the students already know and will aid you in preparing for the field trip.

At this point you may wish to discuss field trip planning with the students, and then have them do the following exercise. The planning discussion can spur interest in the following activity.

*Exercise:* Have the students write a short composition (one or two paragraphs) on what they think they will learn by going to the area. Or have them draw a picture of what they think they will see. After the trip they can write about what they learned, or draw what they saw, and compare their observations to their first ideas about the place. This will give you and the students insights into changes in knowledge that occurred during the trip.

## ENVIRONMENTAL PREFERENCES

*Introduction*

*Goal:* To have the students understand that the preferences they exhibit are based on the values they hold; to clarify what values are and how they relate to the study of the environment; to provide data for later teacher evaluation of environmental attitudes and values.

*Objective:* Students will be able to list several environmental preferences they think are most important.

The environment is an incredibly complex concept to get across to students. The word itself has been overused, even to the point of being exploited. No one definition can suffice entirely, but it is important that the students themselves define what they mean when they use the term. It is important from the very beginning that children understand that *values questions* are an integral part of our study of the environment; that they determine the direction of the decisions we make concerning the environment and even affect how we see the environment.

*Comment:* Decision-making is perhaps the most important of the many skills necessary to understand almost all environmental questions. Decision-making is essentially a value-setting process and requires individuals to have a clear understanding of their own values. Many people are unpracticed in the process of looking at their own values, and can be threatened by the process because it requires self-appraisal. Therefore, values lessons must be approached with an adequate amount of preparation. Many teachers have found it helpful to introduce the parents of students to the materials before using them in class. It is a common error of parents to confuse these exercises with some kind of encounter group, which they are not! These exercises are nothing more than the first step in learning the decision-making process.

*Lesson*

**Materials Needed:** Preference Sheet (one per student)
Pencils

**Activities:** Pass out the sheets. Read the instructions, clarifying as necessary. Give all the students enough time to do the first five choices. Check to see if everyone is marking properly.

You will be using this list of rankings to help you focus student attention on values related to the environment. Ultimately the students will use these values to define what the environment is.

When the preference sheets are competed, put the following grid on the board. Don't put titles on the grid until after it has been filled with student comments. Put only two examples on each side to start the students thinking. Explain that the preferences they hold demonstrate the values they have. Then go down the list with the students, asking them what side to put each particular preference.

| (Environmental Values) | (Personal Values) |
|---|---|
| clean air, parents, (pollution, nature, pleasant friends, planting new trees, nice home) | pleasant friends, feeling of doing good work, (happiness, freedom, respect for self and friends, helping, intelligence, athletic) |

These are just examples for you. Don't write them down before the students suggest them. Some of the values may go on both sides, because they are part of the environment and also personal. For example, pleasant friends may be considered part of the environment as well as a personal preference.

Encourage any answer, but only write down those which follow the spirit of the examples listed in parentheses.

*Ask:*

What is a good title for the list on the right side? Accept any title which seems appropriate.

What title could be used on the left side? (If "environmental values" is mentioned, write it over the left side. If not, write down a close alternative.) Why would environment or environmental values be a good title for this side?

What does the word *(environment* mean? Have students work out their own definition.

Why is it important for us to know what our environmental values are? Do the values you have make any difference in the choices you make? For example, let's say you liked grasslands better than woodlands. How many of you had one or more environmental values in your first five choices? How many had at least one in their second five?

**Teachers**: If time allows, you might ask the students for other environmental values.

Collect all Preference Sheets and save them. They will be used again at the end of the unit for evaluation and discussion.

Name:

**Preference Sheet***

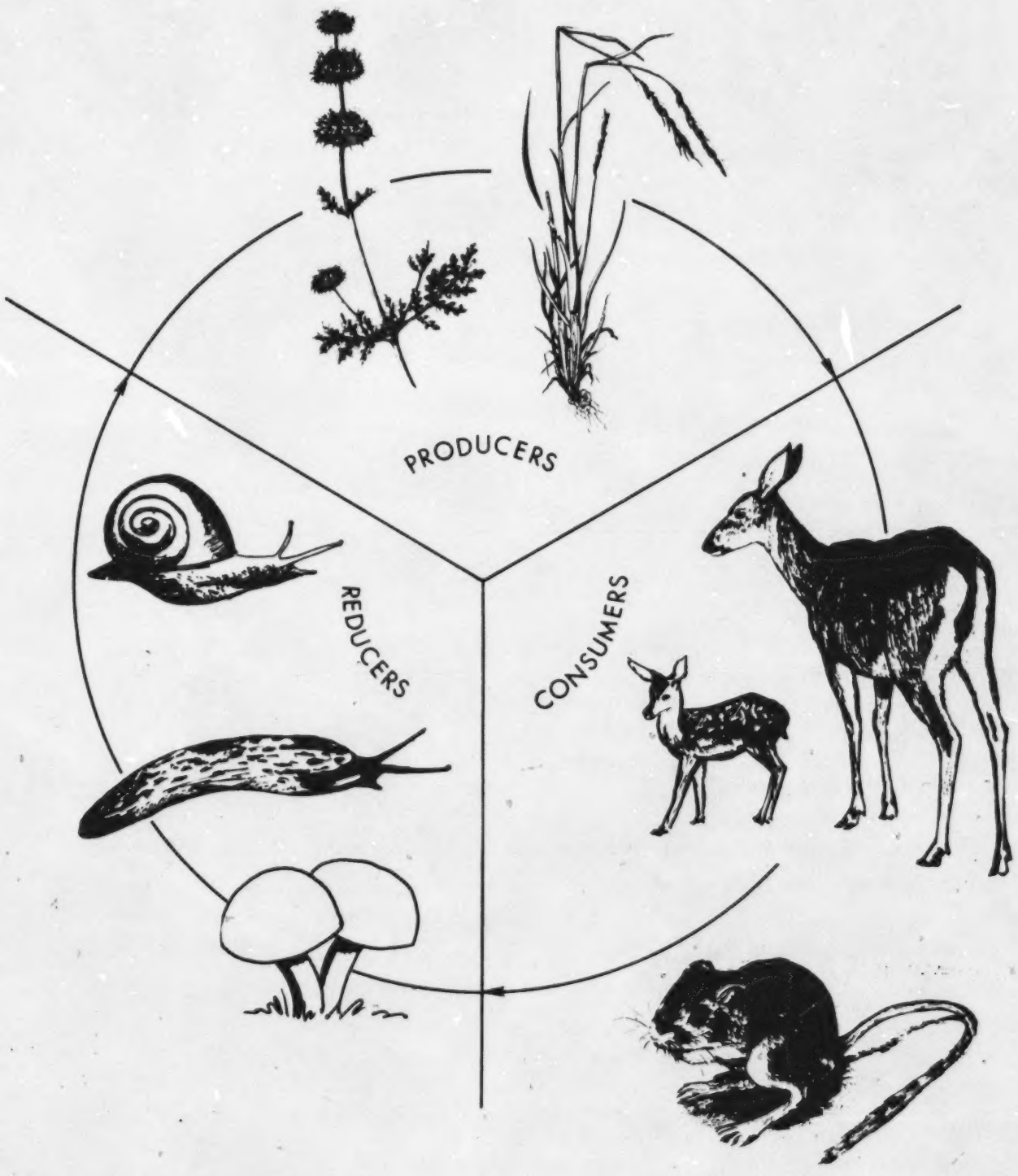
Read the whole list of choices. When you have read the list, put a 1 next to the one you think is most important. Put a 2 next to the second most important. Put a 2 next to the second most important, and so on up to 5.

____ nice home, healthy and pleasant place to live
____ pleasant friends
____ feeling of doing good work
____ happiness
____ having freedom
____ clean air
____ respect for others
____ respect for yourself
____ quiet parks
____ planting new trees after cutting down trees for wood
____ helping others
____ being intelligent
____ being athletic
____ pollution
____ natural beauty
____ people who care for me

Now pick another five you think important and number them in the same way. But this time put a circle around these five numbers.

*Teachers:* When everyone has done the first five choices, read the instructions on the bottom, making sure the students know to circle the numbers of their second five choices.

*Modified from the ERIC materials on Environmental Studies

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## INTERDEPENDENCE I

*Introduction*

**Producer-Consumer-Reducer**

Everything needs some form of energy to function. The ultimate source of all the energy on the earth today is the sun. But not all living things can use the sun's energy directly. Animals and some plants like fungi depend on other types of life to convert the sun's energy into a type of energy they can use. The field mouse depends on grasses and other plants to convert sun rays into grain, and the hawk depends on the field mouse to change the energy of the grasses into meat to eat. Thus *the energy flows* from one type of life to another. The energy-flow circle in the natural environment is often termed the producer-consumer-reducer cycle.

Every living thing can be classified as either a producer-consumer, or reducer. A producer is any plant that can change sunlight and the nutrients left in the soil into energy (food) that can be used by consumers. Consumers are those living things that eat the producers to get their energy. When consumers and producers die, nothing is wasted. The reducers enter the picture, taking all the dead material on the earth and changing it into plant food that can again be used by other plant producers for the soil. If any stage in the cycle is broken, all living things suffer. They are all interdependent. People are consumers, and are not exempt from the cycle.

*Goal:* To introduce the students to the idea of the producer-consumer-reducer cycle and the interdependency among its members.

*Objective:* The student will be able to define producer-consumer-reducer or to classify animals and plants.

The student will also be able to state how an effect on one classification affects the others.

*Lesson*

**Materials Needed**: Producer-Consumer-Reducer Sheets (P-C-R sheets). Ten to 15-minute film (such as *Nipomo the Living Dunes, Bay Tidelands, Tripping with Terwilliger, The Sea Otter, Spring Comes to a Pond, Tide Pool Life,*) or any other you have previewed to see that it is interesting and depicts examples of the P-C-R cycle in a particular environment.

**Activities**: Before showing the movies, pass out the P-C-R sheets. Read the P-C-R sheets to the students. Tell them to watch for several examples of each group, and to write these examples under the correct heading. (Also mention that reducers are often the hardest to find because they are small or like to hide, such as the crab.) Other examples of reducers are sand fleas, bacteria, worms, mushrooms, and ghost shrimp anything that takes dead material and eats it or changes it in some way. Producers are any plant, from algae and seaweed to sycamore trees, that use soil and sunlight to make food. Consumers are animals that eat the producers or eat other consumers. The students will not know the names of many of the things. Have them give things their own names and describe them. That's ever. better.

*After the movie, ask:*

What are the producers in the environment depicted in the film? The reducers? Put some examples of each on the board. Group the examples so they are related to each other.

*Ask:*

What would happen if some of the reducers died? (There would be no nutrition in soil or in sea water, so producers would die off and so would consumers.)

What would happen if more consumers came into an area? (The number of producers would decrease.) Then what would happen?

If one of the three changes, what happens to the other two? Do they remain the same?

Write the headings for three columns on the board, as in the following example. (Some animals may be both consumers and reducers, like slugs and beetles.)

| *Producer* | *Consumer* | *Reducer* |
|---|---|---|
| plants | grasshopper | earthworm |
| trees of any kind | snail | slug |
| weeds | rabbits | maggot |
| vegetables | dogs | beetles |
| | gophers | bacteria |
| | humans | sandfleas |
| | | beachhoppers |
| | | turkey vulture |
| | | termite |
| | | crab |

Have each student list some producers, consumers, and reducers that might be found in a garden. Don't forget people. Have them put those lists on the back of their P-C-R sheet. Then briefly review the sheets with the students.

As you go through the lists of producers, consumers, and reducers it will become obvious that the distinctions between them are not always clear-cut. A slug eats the fallen leaves and dead materials of the forest, but it also eats fresh green leaves, too. So a slug is both a consumer and a reducer. But its main role is that of eating and breaking down dead matter, so it can arbitrarily be put in the reducer category. It is important to remember that categories don't exist in nature, only in the minds of people, and you are free to define your categories as tightly or as freely as you wish as long as there is some agreement among those using the categories.

Take time to clarify the categories with the students. If problems arise about where to place an organism, have the students think of the categories in terms of the organism's major function.

Name: _____

## P-C-R Sheet

This is your own private P-C-R sheet. It's yours and nobody else's.

What's P-C-R? It stands for Producers, Consumers, and Reducers. Everything living on this earth needs energy to make it work and materials to make it grow or produce more living things.

*Producers* make food. All producers are plants because they are the only things on this earth that can make their own food from the sun's energy and the soil's materials.

*Consumers* have to get their energy from the food made by the plants. So consumers are those things that eat producers or even other consumers. Consumers usually are animals. They can't make their food from the sun's energy.

Every living thing must die. When it does, something has got to return the building blocks and the energy back to the soil. *Reducers* do this. They chew or break up the dead producers and consumers and put their building blocks back into the soil or the sea where new producers can use them.

Watch the film and make a list of those things you think might go into each group. Go ahead and guess!

**Producers**

_____ _____

_____ _____

_____ _____

**Consumers**

_____ _____

_____ _____

_____ _____

**Reducers**

_____ _____

_____ _____

_____ _____

# INTERDEPENDENCE II

*Introduction*

**People as Consumers**

The human animal depends on producers as does any other animal consumer. In our culture today this is sometimes hard to remember. We are often isolated from the natural environment. Producers are not within our view. They are in parks or on faraway farms. So our feeling of dependence is diminished. Such was not the case in Native American cultures. The Indians of California lived in constant awareness of their place in nature, and their dependency on other parts of nature.

California Indians were hunters, fishers, and gatherers. They depended on nature for survival. When there was a dry summer and not much grew, the people had little to eat. In an effort to explain why some years were hot and dry and others were moist and productive, one Indian legend had the Sun and Coyote, two gods, playing a game of chance. They played for the whole year. If at the end of the year Coyote won, there was a fine summer and the people prospered. If the Sun won, he got to shine all summer long, and the land dried up, the producers died, and the people suffered.

*Goal:* To acquaint the students with an example of the Indians' attempt to explain the world in which they lived. To familiarize the student with the idea that people are an integral part of the producer-consumer-reducer cycle.

*Objective:* Students will show the effect of a dry or normal summer on members of the producer, consumer, reducer cycle, stating whether the members increase or decrease, and explaining why.

*Lesson*

**Materials Needed:**

Five kidney beans for each group of three students. Class of thirty = 10 groups - 50 beans.

Game of Chance Sheets, one per group.

Next Year Sheets, one set per group.

Five example beans marked with pencil on one side.

**Activities:** Read the introduction to the class.

Pass out the Game of Chance sheets.

Divide the students into groups of three students: one student, the Sun; another, the Coyote; and the third, a Referee.

Pass out five kidney beans to each group. Carefully read the instructions and answer any questions about how to play the Game of Chance. Then explain that after five quick games they are to pretend the year is up. If the Sun wins the most games, he gets to shine all year long and the earth will be dry. If Coyote wins, the Sun must make way for the rain for part of the year and the earth will be comfortable and moist so that things may grow.

Pass out the Next Year Sheet (which includes a list of producers, consumers, and reducers) and read the instructions. Answer any questions.

When the students are done, ask the groups to share their data and explanations.

The discussion should focus on people and how changes affect us, and how we affect other living and nonliving things. For example, during a dry spell, if the Indians had collected all the pine nuts, what would have happened to other consumers like the wood rat who also ate the nuts? What would have happened to the growth of new pines?

Names:

## Game of Chance

This is a game like one played by a group of California Indians, called the Chumash.

You should be in a group of three people. Decide who will be the Sun, who will be Coyote, and who will be the referee and scorekeeper.

The scorekeeper takes the five beans and, with pencil or marker pen, blackens one side of each bean. The other side is not blackened.

The referee then gives the beans to the Sun, who takes the first turn.

**To Play:**

You put all five beans in your cupped hands and shake them well. Then you quickly open up your hands so that all the beans drop together on the desk top. You then count the number of beans with black sides up and the number with clear sides up. Alternate, first the Sun then Coyote. When each has had three turns, that game is finished.

**To Score:**

If 1 or 4 black sides are up, the player gets no points.

If 2 or 3 black sides are up, the player gets 3 points.

If all 5 black sides are up, the player gets 5 points.

If no black sides are up, the player gets NO points.

Add up the scores of each player's three turns. The contestant with the highest total score wins the game.

Play five games.

## SCORE SHEET

| | *Sun* | *Coyote* |
|---|---|---|
| Game 1 | | |
| Game 2 | | |
| Game 3 | | |
| Game 4 | | |
| Game 5 | | |

Name:

## The Next Year

Coyote

Circle One: won the most games.

The Sun

So next year the earth will be_____. (Describe the weather and what the streams and rivers will be like.)

Here is a list of some producers, consumers, and reducers with a few facts about each. Tell whether they will do well or poorly next year, then explain. Remember that there may be many plants or animals, and that some probably will live through even the hardest times. Ask yourself, will these things increase in number or decrease?

**Producers**

Bracken fern – A plant that needs moisture and lots of shade.

Coastal liveoak – A tree that grows in the coastal areas of California. It produces acorns, which the Indians prepared for food.

Pine – A tree that can thrive in dry weather. Indians and many animals eat the nuts in its cones.

**Consumers**

People – Some Indians ate fish and depended on the rivers, sea, and wild plants for much of their food. They also needed lots of acorns for their bread. Sometimes they ate pine nuts. They needed water to drink.

Wood rat – Lives in forest areas where there is much brush. Makes its nest of dead branches and moss. Eats plants, acorns, pine nuts, and berries.

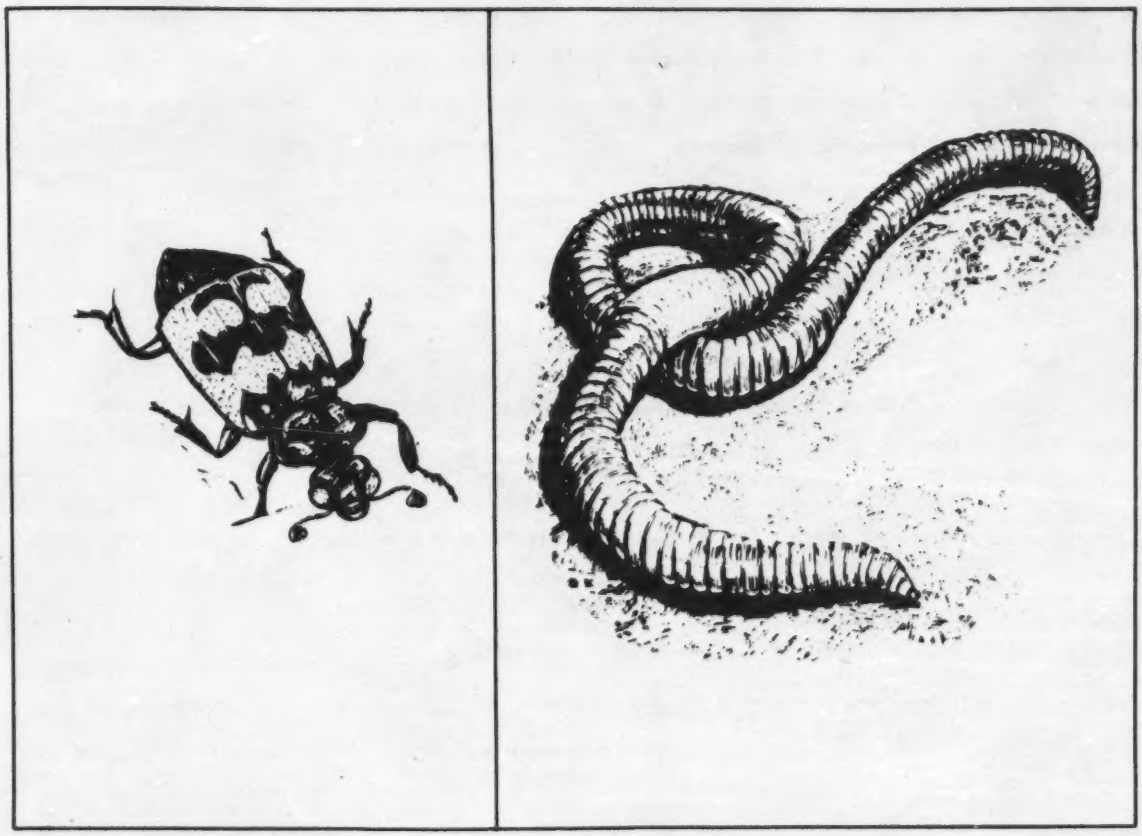
Kangaroo rat – Lives in open, dry areas. Makes its water from the food it eats. Doesn't need to drink water.

**Reducers**

Bacteria – Very tiny living things that break down dead material. They need a damp, warm place, but one that is not too hot.

Beetle – An insect that likes to eat dead things, like wood and meat. Some beetles eat live plants. Some need very little moisture and can even live in a desert. Also they do well where it is wet.

Earthworm – It is the common worm everywhere. It actually eats dirt. It needs water to keep the soil soft. If the soil isn't at least a little wet, the worm can't eat and will dry up. If the soil is too wet, the worm will drown.



# ADAPTATION

*Introduction*

## Behavioral and Structural Adaptation

Change is a never-ending part of life and the environment. It may take the form of climatic changes, or changes in the landforms. These changes are generally very slow, with the exception of natural disasters like hurricanes, earthquakes, and others. Most dramatic and rapid changes have been brought about by people. No matter how the changes are made, life in the environment must adjust. This adjustment is called adaptation.

Adaptation can take two forms, structural and behavioral. A structural adaptation occurs when an actual part of the body of the living thing changes to suit the needs of the new environmental conditions. A behavioral adaptation occurs when the animal starts doing different things to adjust to the change. It might change its drinking habits in response to a change in rainfall. It might hunt different game, or hunt in different places.

Structural adaptations take time to develop for they depend on the genetic process of mutation and evolution. For such adaptations to take place, changes in the environment must be slow, or so minor that they don't threaten the organism's existence.

For quick and major changes, animals need to adapt their behavior. The ability to adapt behavior has determined the survival or extinction of many animal species in the face of rapid and major changes. One reason people have been so successful to date, and are able to survive in so many environments, is due to their ability to adapt their behavior. The use of tools, fire, and shelter are all behavioral adaptations.

*Goal:* To acquaint the student with the concepts of structural and behavioral adaptation and how they relate to species survival.

*Objective:* The student will be able to identify from a list of adaptations those which are structural and those which are behavioral.

*Lesson*

**Materials Needed:**

Adaptation transparencies. (Lines drawings to be used as patterns for making transparencies may be found on pp. 23-26.)

Script for transparencies (see pp. 23-26).

Adaptation Sheets, one for each student.

**Activities:** Show the slides and read the script as you go along.

*Ask:*

What is a definition of behavioral adaptation? Can you give some examples? (Write the two categories of adaptation on the board. When a correct example is given, put it down. If a structural example is given, tell the student it is structural and write it down under the proper category. You might ask the class if they all agree if a wrong answer is given. They generally catch the error.) Repeat for structural adaptation.

Pass out the Adaptation Sheets and read the instructions. This activity is best done in groups of 3 to 5. This allows the students to check against each other, to share ideas, and to learn to cooperate. If the sheets are done individually, time must be taken to go over them after the activity.

*Ask:*

Which do you think is more important for future human survival – structural or behavioral adaptation?

*Values Question:*

Do people have a right to make rapid changes in the environment, like building dams or freeways?

## Script for Adaptation Lesson 5

**Transparency No. 1**

The world is always changing.

Living things have to adjust (adapt) to the changes or they don't survive. They must adapt.

There are two types of adaptation.

One is structural. Structural adaptation is a change to a part of the animal or plant, like a muscle or a leaf.

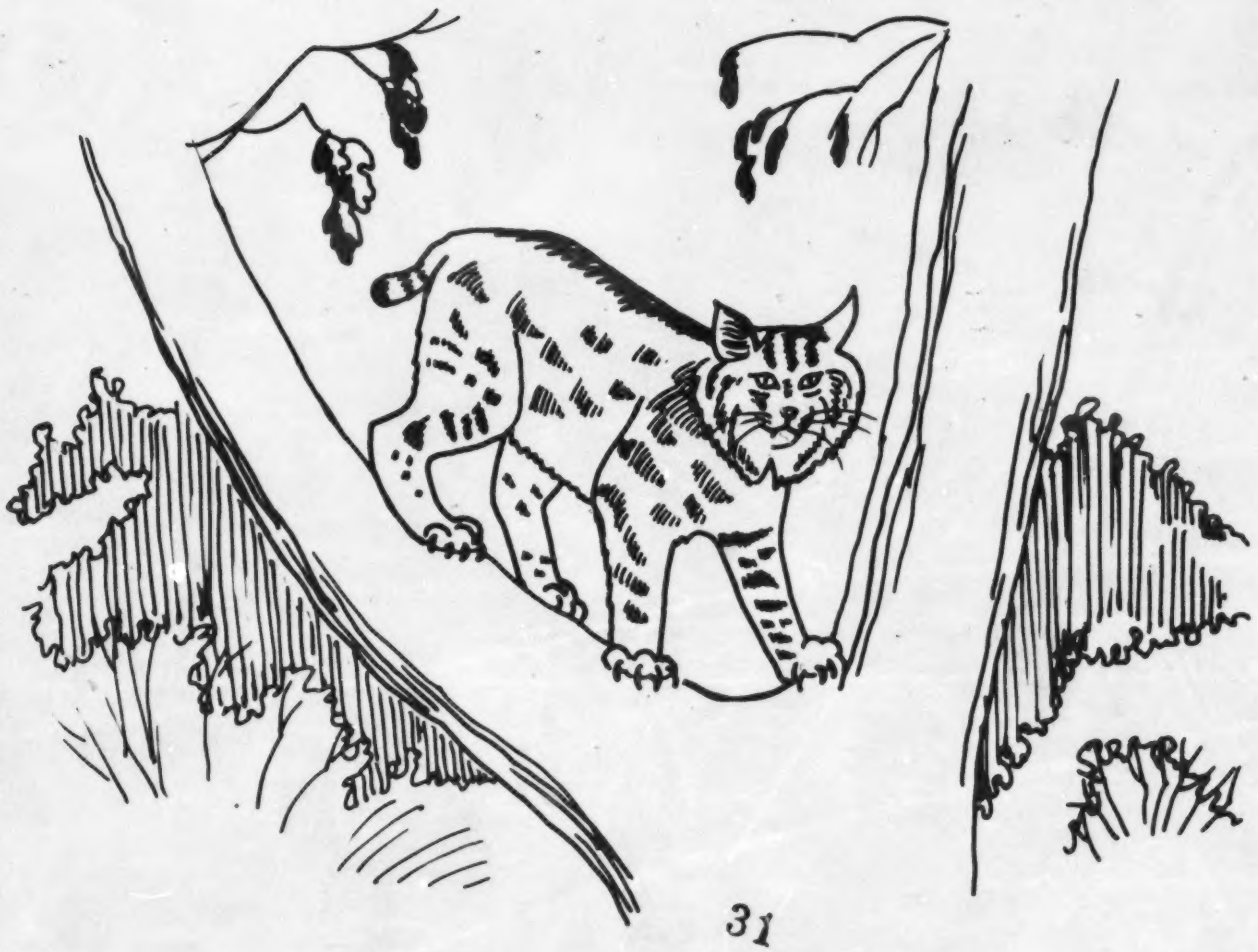
**Transparency No. 2**

A bobcat's sharp claws are a structural adaptation which helps the animal to survive.

How do they help it to survive?

A wing is a structural adaptation to a bird's need to escape enemies and hunt. It allows the bird to fly.

A leaf is a plant's structural adaptation to the need for sun.



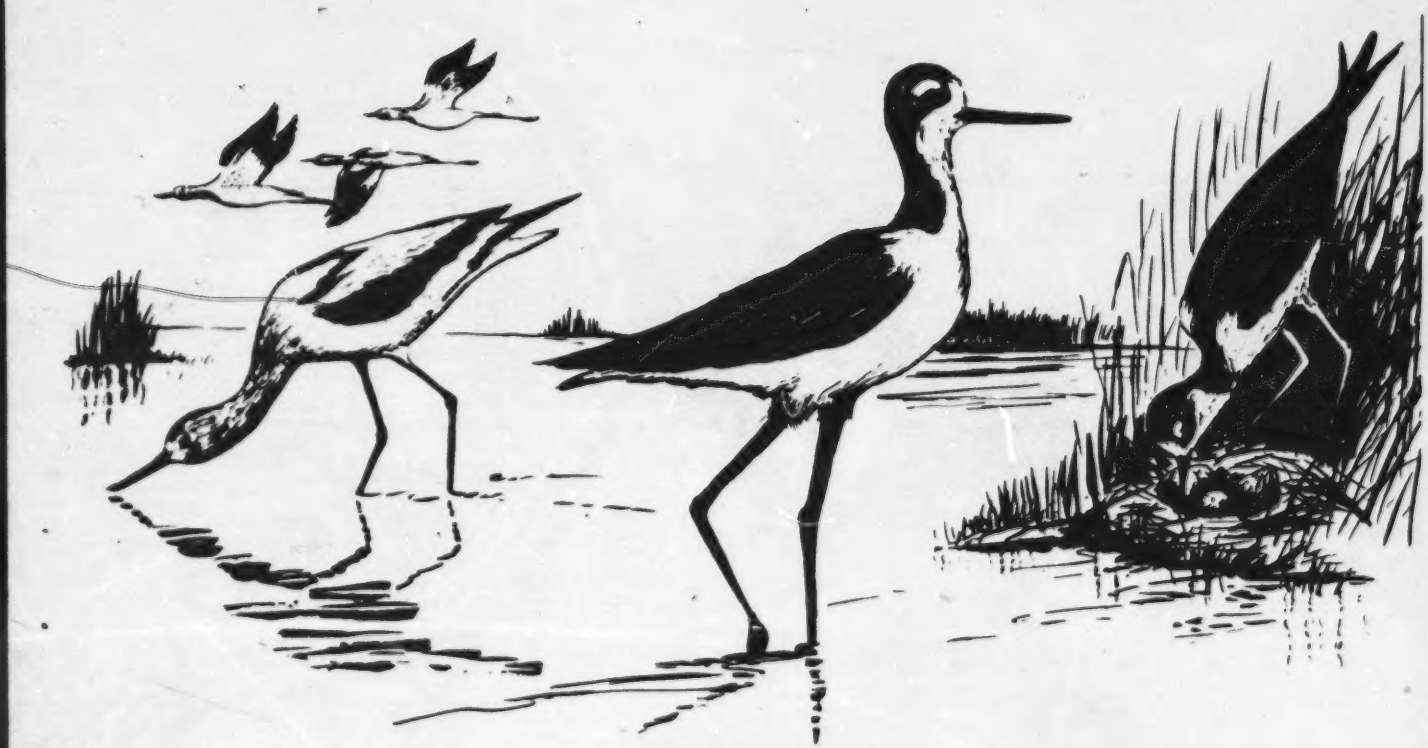
31

**Transparency No. 3**

The other type of adaptation is behavioral adaptation.

The sea otter dives for its food in the sea. That is a behavioral adaptation. It is an action, a way of doing things.

The avocet swishes its slightly curved bill back and forth in the shallow water to catch food. The stilt uses its long beak to probe in the mud for small snails, insects, and worms. These actions are behavioral adaptations to get food.



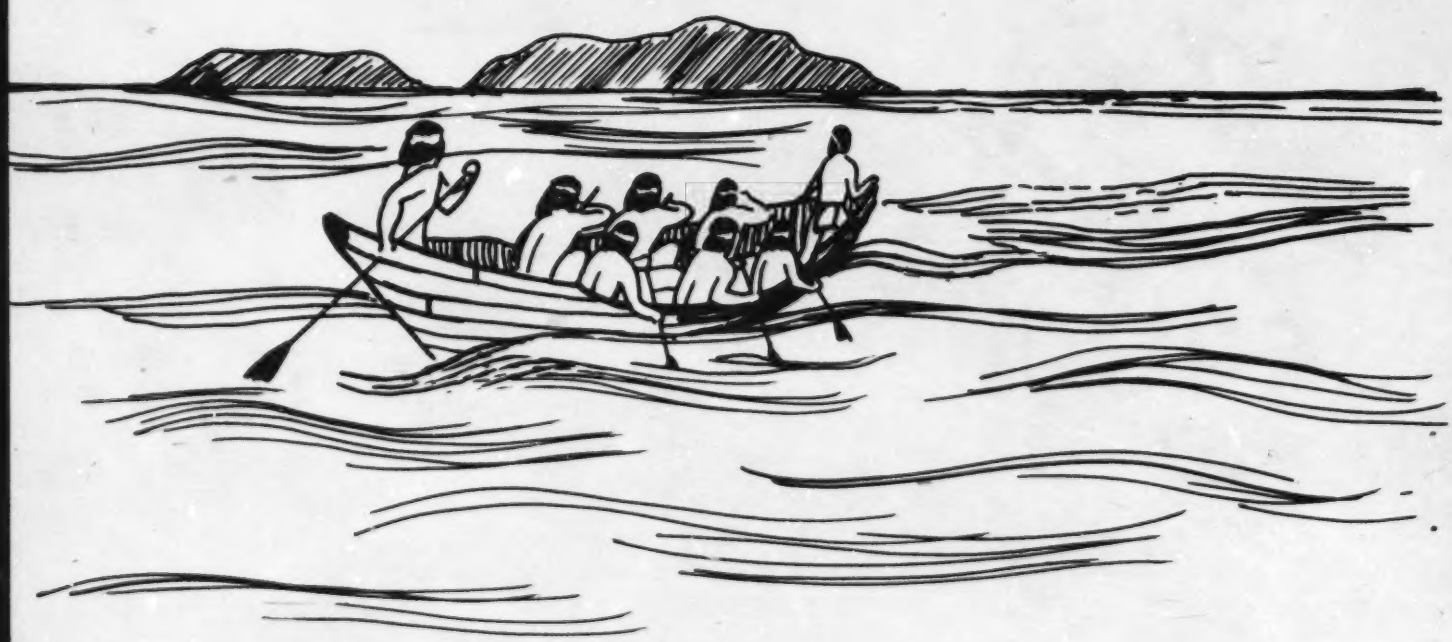
*Avocet* *Black-necked stilt*

**Transparency No. 4**

People build shelters for protection. This is a behavioral adaptation. Why is it a behavioral adaptation and not a structural one? Look at the picture. What kind of adaptation is this?

Most human adaptations are behavioral. When people must adapt they change how they act. Human physical features aren't changed by behavioral adaptations.

Which do you suppose can happen faster, behavioral or structural change?



Name:

## Adaptation Sheet

This is your own private Adaptation Sheet. Protect it with all you've got!

Below is a list of adaptations. After each one put B if it is a behavioral adaptation or S if it is a structural adaptation. Also tell what the adaptation is for.

Example: the wing of a bird *S to fly in the air*

1. Teeth of a shark
2. Otters using a stone to open an abalone shell
3. Webbed foot of a duck
4. Fins on a whale
5. People changing the things they eat during different times of the year
6. Human thumb
7. A sunflower pointing towards the sun all day long
8. Birds migrating south for the winter
9. Tree leaves falling off during the winter
10. People using tools like bows and arrows
11. Now think up some examples of your own.

Now you can put all these examples on a chart like this on the back of this sheet:

| **Structural Adaptations** | **Behavioral Adaptations** |
|---|---|
| *Examples* | *Examples* |

# CAMOUFLAGE – A STRUCTURAL ADAPTATION

*Introduction*

**Adaptations that Hide an Animal**

Only a very few animals (the bear, for example) do not need to be protected from predators. To assure survival, most animals have structural adaptations that reduce their chances of being caught and eaten. For some, the adaptations are in the form of built-in weapons that can be used against the predator. The skunk is one such animal. Some animals depend on adaptations for speed. Adaptations can also protect animals by camouflaging them. The gypsy moth and the spotted fawn are good examples of camouflage for protection, which makes it hard to see them.

*Goal:* To add to the students' understanding of the nature of structural adaptations.

*Objective:* Students will be able to indicate their understanding of structural adaptations for camouflage by making model animals with adaptations that prevent them from being easily found.

*Lesson*

**Materials Needed:**

Solid vegetables like potatoes, carrots, beets (to be used for animals' bodies)

White paint (latex or spray paint)

Clay (Plasticine)

Tape

Water colors, or tempera paint

Brushes

Glue

Scraps of colored paper or tissue paper

Toothpicks

Cotton

Popsicle sticks

**Activities:** Before the activity, paint all the vegetables white so they are conspicuous in almost any environment.

Select two areas on the playground which are far enough apart so that a group working in one area cannot spy on the other. (Opposite ends of the blacktop or field are excellent.)

Divide the class in half. Give one site to each half.

Show the students the materials they will use to make their animals.

Then take them out so they can select a place in their part of the playground where their animals can live and hide.

After a few minutes (enough so that each student can find a place for the animal), take the students back to the classroom. Explain the need for protective adaptations (see introduction to this lesson). Introduce the task: "Make an animal from your white vegetable that blends into, or is hidden by, the natural surroundings."*

Allow each group out to place their animals and then exchange areas so the groups can look for each other's animals. Mention that those not found are well adapted to their surroundings. One important idea is that camouflage is a structural adaptation and that hiding is a behavioral adaptation. Since this lesson is one on structural adaptation, don't have the students hide their animals. The point is to have the animal out where it might be seen, but so well camouflaged that it is not recognized.

*When back in class ask:*

Why is this kind of structural adaptation important?

What other kinds of structural adaptations can protect animals besides those that hide them?

*Adapted from OBIS Study Guide, "Invent an animal adaptation." Lawrence Hall of Science, University of California, Berkeley, Ca. 1975.

## PEOPLE'S ADAPTATION TO THEIR WORLD

*Introduction*

Indians lived in California long before the coming of any Europeans. They, like all other people, had to adapt to the environment they lived in. Their adaptations were behavioral ones that helped them to survive. They were hunting peoples. One of their adaptations was to go where the food was. When the fish were in the streams, they were at the streams with their nets and spears. Later, when the acorns fell in the mountains, they were in the mountains gathering acorns. The Chumash, of the southern California coast, built special canoes made of planks, which were tarred to make them waterproof. Making a special tool to use for travel on the ocean is an adaptation. The building of a canoe is a behavioral adaptation. So is adapting to the weather. The Indians adapted to wet, cold winter weather by building huts of various sizes and materials.

Our culture today adapts to many of the same things the Indians adapted to. Californians today adapt to the wet, cold winters. We adapt to coastal areas, dry summers, and dry land. But our behavioral adaptations are not quite the same as those of the Indians. For example, in farming we have relied more on machines and complex fertilizers than on the land itself.

*Goal:* To create an understanding that people adapt to their environment through changes in behavior, not changes in body structure. To emphasize the importance of culture and technology in determining how a group of people adapt to an environment.

*Objective:* The student will draw two sets of pictures demonstrating the difference between behavioral adaptations of the Indians and those of today's predominant culture.

*Lesson*

**Materials Needed:**

Drawing paper (1 or 2 pieces per student)

Crayons or colored pencils

**Activities:** Read the introductory statement on how people adapt to their world.

You will probably want to develop a short presentation about the Indians of your specific area.

*Put these human problems up on the board or on a poster:*

getting bread

being comfortable on a cold night

carrying heavy loads

protecting themselves from enemies

protecting themselves from wild animals

moving to a new location

buying things

getting water

seeing far away

*For each human problem ask:*

What behavioral adaptations do we have that help us do these things?

What behavioral adaptations did the Indians have?

Example: To get bread, we go to a store. The Indians collected acorns.

Do this for all the above functions and then pass out the paper. Instruct the students to pick any two of the nine problems and to draw today's solution and then the Indian solution. A short sentence below each picture might help other students and the teacher to better understand the drawings.

If two pieces of paper are passed out, have the students fold each paper in half. If only one is passed out, instruct the students to fold their papers in fourths.

# ENVIRONMENTAL VALUES

*Introduction*

**Value Voting**

It is sometimes fun to vote openly for things you think are important. It is a public statement, and it helps a person to reaffirm his values.

This is a short activity that will give the students and the teacher an opportunity to see how the class feels on certain things – the environment among them.

*Goal:* To get the students to openly affirm some of their feelings on the environment and their world.

*Objective:* The students will vote for those values they feel are important.

*Comments:* Children ages 9-12 generally have acquired their values from others rather than through self-assessment and conscious choice. There is nothing wrong with this. It is a fact of life. As children are exposed to more and varied values, they become aware of choices to be made. They begin to make some of their own choices. "Values voting" has an important function – to expose students to some of these varied choices. Don't be upset if a student's values seem to come from parents, friends, or other individuals the child feels are important (movie personalities, comic book characters). Just try to get the students to recognize where their values come from. This is one step in the process of maturation leading to individual decision-making.

*Lesson*

**Materials Needed**: The teacher will need the Values Voting Sheet (p. 37 ).

**Activity:** Tell the students they will have a chance to vote on several kinds of statements. If they agree with a statement, they should raise their hands. If they disagree, they should keep them down.

Read the Values Voting Sheet. Give the children some time to make up their minds after each question. Give the children the opportunity to submit their own questions. Keep a tally for yourself on Nos. 5, 8, 11, 12, 14, 18, 19, and 21. These are the environmental questions.

*Ask:*

Where do you get your values?
Are your values the same as those of your friends, family, favorite star?
Who do you know who feels the same way you do?
Did you get your feelings from them?

## Values Voting Sheet

**How many of you:**

1. Like to swim?
2. Like to chew bubble gum?
3. Like to camp in the woods?
4. Like to be by yourself?
5. Like to go on long walks in the country?
6. Like to walk down city streets?
7. Like to shop in a large crowded store?
8. Like to see a movie about wild animals?
9. Like to see a movie about people?
10. Like to watch the moon move across the sky?
11. Like to take a close look at caterpillars, birds, plants, and other living things?
12. Like to put your bare feet on warm grass?
13. Like to see buildings built?
14. Like seeing many new houses built?
15. Like redwood houses?
16. Like motorcycles?
17. Like hiking boots?
18. Think motorcyclists ought to be careful about the environment when they are riding around?
19. Think cars should be equipped to stop pollution?
20. Think some types of trees and other living things should never be cut down or killed?

Add as many others to the list as you like.

## III
## THE FIELD TRIP

As we mentioned earlier, this book was designed to be used with supplemental guidebooks for particular state parks, or with other materials for any outdoor area in the state.

If you live near one of these state parks you can order books two and three in this series, *The Main Event* and *The Data Book*.

If you are going elsewhere, you will have to research the background information. State and local park and recreation personnel can be helpful. Try using the following suggestions in designing your own field trip to inform, excite, and reinforce ideas covered in this volume.

The first step is to carefully choose a field trip site. It can be a creek, pond, or forest, or a local, regional, or state park. Teachers who have used this book and their own resourcefulness have chosen sites nearby as well as far from school.

Check park agencies and libraries to see if some kind of information pamphlet or educational material is available about the site.

As you plan your trip, remember that something as simple as walking down a creek or path – with the students looking for producers, consumers, and reducers – is a tremendous learning experience. Seeing the habitats of these organisms will greatly reinforce their classroom learning.

After you choose a site, visit it two or more times. Take along a plant and animal identification guide from your school or local library. Ask a high school science teacher to come to the site with you. Identify producers, consumers, and reducers. Don't forget to look for signs of human changes that can be pointed out to the class.

Look at the lay of the land – the hills, valleys, ridges, and so forth. How does the land affect plant and animal life found at the site?

After spending some time there, devise one or two interesting and simple activities, such as classifying leaf shapes, describing plant types, or drawing plants and animals found at the site.

For example, when you take the students on the field trip, bring along magnifying glasses. Have the children draw from nature, once with an object under the glasses and once without. This will make the students aware of details in the object and how a glass can help them see more.

The possibilities are endless. The important thing is preparation. A well designed unit will equip the students with a set of concepts so they can understand the purpose of an insect's wing, a grasshopper's color, or the swift darting movements of a fish. When the students are well prepared, it is surprising how much more they will understand about the outdoor environment.

You might also want to obtain one or more of the supplemental materials listed in the back of this book. In particular, OBIS (the Outdoor Biological Strategies Program) has come out with an excellent packet of biological science activities for use on the trail. It could provide you with the core of materials you will need for your field trip.

# IV

# TESTS AND EVALUATION

## STUDENT EVALUATION OF THIS LEARNING EXPERIENCE

*Introduction*

The activities after the field trip are meant to reinforce and evaluate what has been learned and felt by the students during the unit.

The emphasis has been on interdependence (the relationship of environmental parts to one another) and adaptation (the way organisms change to survive in a changing environment). Any effort at summary or evaluation of content should be directed towards these two concepts. Tying together the emphasis on concepts has been a thread of values and feelings. Students have been asked to consider how they feel about the environment. This, too, should be considered an integral part of any summary or evaluation.

*Follow-up Lesson 1*

*Goal:* To reinforce the students' understanding of interdependence and adaptation. To provide the teacher with informal data with which to gauge the effectiveness of the unit.

*Objective:* Students will be able to decide and then discuss the five most important things they feel they have learned from the unit and field trip.

*Lesson*

**Materials Needed:**

3 x 5 cards (no lines). Half sheets of which paper can be used.
Crayons
Scotch tape

**Activities:** Divide the class into groups of five students. Pass out the cards, five per group (one for each student).

Ask the students for some examples of things they learned on the field trip and in class.

Each group should pick a leader to represent them later when the work is shared with the rest of the class.

As a group, the students should decide the five most important or interesting things they have learned from the unit and the field trip.

Eash student chooses one of the five and writes it down on the back of the card. Then the student draws a picture of it to show to the class.

When everyone in the group has finished drawing (after about 10 minutes or so), have each group tape the five cards together. Most important goes at the top, second most important next, and so on.

Then each group will have a five-card foldable display to use as the beginning of the discussion.

Have the students put their names on the cards they did, and then have each group leader post the card display on a bulletin board.

*Follow-up Lesson 2*

For this lesson, which is a discussion, the group representatives will use the card displays to tell the class about the things learned on the field trip and in class.

*Goal:* To assist students in distinguishing between facts and feelings about the field trip and in relating this distinction to interdependence and adaptation.

*Objective:* Students will identify their feelings and concepts about the environment and recognize when they encompass interdependence or adaptation, or both.

*Lesson*

**Materials Needed**: The five-card foldouts made during the previous activity.

**Activities**: Have the group representatives come up one at a time, get their group card foldouts, and explain them to the class.

As each of the "important things learned" is read off and quickly explained by the representatives, the teacher puts a short phrase on the board which summarizes the items. Repeated comments are not listed. A list of 20 to 30 items should result.

Ask the students to decide for themselves which of the things learned are emotions or values and which are concepts or facts.

Draw three columns on the board. Label them "Emotion and Feelings," "Concepts and Facts," and "Both or Not Sure".

Call on students one at a time to fill the columns, using the list of items recorded by the group representatives. Be prepared to add some of your own if there are few items about interdependence or adaptation. Ask which of these are examples of feelings and emotions and which are examples of concepts and facts.

Encourage discussion about where items should be placed. Ask the students to justify their decisions.

Have the students divide their representatives' lists again into items which are examples of interaction and interdependence and those that are examples of adaptation.

Write the two categories, interdependence and adaptation, on the board.

*Ask:*

Which of this first list (point to the original list) are examples of interdependence? Which are examples of adaptation?

What would happen if an animal could not adapt to changes? Give some examples of changes.

How might adaptations or changes to one thing affect others? (Give an example to start the thinking. Ask for examples from students.)

It might be helpful to include a writing exercise which requires the students to explain their feelings about the field trip and the drawings made for the first follow-up lesson. The themes might be:

Why you chose to draw what you did.

What is happening in your picture.

What you liked about your field trip.

## PRE – AND POST-TEST

The test questions on the following pages have been designed to partially measure the degree of successful learning from this unit.

The test should be administered at least one week before any of the preparatory lessons are begun, and again at the conclusion of the unit.

Name:

## Interdependency and Adaptation

Here's an example of interdependency:

PLANTS
(make food)

?????

DEER AND OTHER ANIMALS
(eat plants)

Circle the letters of the best answers.

1. What's missing?
   a. producer
   b. consumer
   c. reducer

2. What kinds of things go at the question mark?
   a. earthworm or mushroom
   b. cat or dog
   c. tree or horse
   d. none of the above

3. Which is a consumer?
   a. tree
   b. elephant
   c. weed
   d. mushroom

4. Which is a reducer?
   a. cat
   b. mushroom
   c. pig
   d. weed

5. Which is a producer?
   a. person
   b. oak tree
   c. flea
   d. clam

6. Which one best shows the interdependency of life?
   a. An Indian builds a pot out of stone for his family's cooking.
   b. A farmer changes his crop from rice to carrots. The rabbits increase in number, and the foxes which eat the rabbits also increase.
   c. Fire destroy the grasses and plants in an area and it gets all dusty.

7. What might happen if a man chopped down an oak tree?
   a. The owl who lived in it flies away. (Owls eat mice.) The mice increase in number.
   b. The owl who lived in it would fly away, but nothing would happen to the mice.
   c. The falling tree would scare away the mice.

Name:

**True or False**

1. If a group of foxes dies, it will have no effect on the plants in the area. (Foxes eat animals like mice, rats, and rabbits.)

2. People do not have to depend on nature.

3. People and their tools have little effect on the environment.

4. Consumers, producers, and reducers are everwhere in the world, even in the oceans.

5. If something happens to a natural area for birds in California, it might have an effect on what happens to foxes in Alaska, if the birds are the type that fly to Alaska.

6. California Indians depended on nature. People today don't have to.

7. Producers are animals that eat plants.

8. Reducers are animals or things like mushrooms that change dead material into food for the soil.

9. Animals that eat plants are consumers.

10. Animals that eat other animals are consumers.

Circle the letter of the best answer.

1. Adaptation is
   a. the changes made by the earth.
   b. the changes in behavior or structure of living things to help them survive.
   c. the changes people make on the face of the earth.
   d. none of the above.

2. What would probably happen if a man cut down the weeds in a field and planted grass?
   a. The animals that could adapt to the new area would leave.
   b. The animals that could not adapt would have to find a new home or die.
   c. All the animals that were there before could stay.
   d. The plants and animals in the area would not be affected.

Name:

**Here's a list of adaptations:**

1. bird's wings
2. rat's sharp teeth
3. mouse's nervousness
4. the way a lion hunts
5. the raccoon washing its food
6. people using tools
7. an eagle's excellent eyes
8. fish fins
9. whale's breathing hole
10. a deer lying still when it is scared

1. Which adaptations are structural and which are behavioral?
   Just give the numbers.

**Structural** **Behavioral**

**True or False**

1. Camouflage is a type of adaptation.

2. Animals that have the correct built-in tools will survive better than those that don't.

3. Animals don't have to adapt to changes in the environment.

4. Behavioral adaptations are changes in how an animal acts or does things that help it to survive.

5. People can change the environment much faster than many animals can adapt to the changes.

6. People adapt mostly by the way they act, not by changes of their body parts.

7. A light green bug would survive better in an area of dark green trees than a dark green bug.

8. If an animal is not well adapted to its environment, it will probably survive in that environment.

**Pre-Post Test Answers**

**Circle one**

1. c
2. a
3. b
4. b
5. b
6. b
7. a

**True or False**

1. False
2. False
3. False
4. True
5. True
6. False
7. False
8. True
9. True
10. True

**True or False**

1. True
2. True
3. False
4. True
5. True
6. True
7. False
8. False

**Circle one**

1. b
2. b

**List**

| Structural | Behavioral |
|---|---|
| 1,2,7, | 3,4,5, |
| 8,9 | 6,10 |

# V

# RELATED INFORMATION

## List of Materials Needed

Lesson 1 – None

Lesson 2 – Values Sheets (see p. 11 )

Lesson 3 – P-C-R Sheets (see p. 16 )

Film (see pp. 13 )

Lesson 4 – Kidney beans (55 for class of 30 students)

Game of Chance Sheets (see p. 20 )

Next Year Sheets (see p. 21 )

Lesson 5 – Adaptation Transparencies (see patterns on pp. 25-27 )

Script for Transparencies (see pp. 25-27 )

Adaptation Sheets (see p. 29 )

Lesson 6 – Solid vegetables like potatoes, carrots, beets (one per student)

White paint (latex or spray paint)

Clay

Tape

Water colors or tempera

Brushes

Glue

Scraps of colored paper

Toothpicks

Cotton

Popsicle sticks

Lesson 7 – Drawing paper (2 pieces per student)

Crayons or colored pencils

Lesson 8 – Values Voting Sheet (see p. 37 )

Follow-up Lesson 1 – Unlined white 3x5 cards (1 per each student)

Crayons

Scotch tape

Follow-up Lesson 2 – Student cards

Lined paper

## Recommended Supplemental Units

OBIS, Outdoor Biological Strategies,

A package of ideas and task cards for teacher and elementary school student which cover outdoor biological activities.

OBIS
Lawrence Hall of Science
Univ. of Calif.
Berkeley, California 94720

Ecopolis,

A simulation game and role-playing experience for elementary school ecology awareness.

Interact
P.O. Box 262
Lakeside, California 92040

ESS, Elementary Science Study

An activity-oriented biological science program for the elementary classroom. Students learn scientific method and biological processes through involving activities and simple experiments.

ESS
California State Series
California State Department of Education
Sacramento, California

Units include:

| | |
|---|---|
| Animals in the Classroom | Earthworms |
| Brine Shrimp | Mosquitos |
| Butterflies | Pond Water |
| Seeds | Crayfish |

SCIS, Science Curriculum Improvement Study

A series of ecological units and materials developed by the Lawrence Hall of Science at the University of California for elementary classroom use.

SCIS
Rand McNally and Company
P.O. Box 7600
Chicago, Ill. 60680

Units include:

| | |
|---|---|
| Environments | Communities |
| Populations | Life Cycles |
| Ecosystems | Organisms |

## Film List

### Suggested Titles

Most of these films should be available from your school district's audio-visual center.

**Social Science**

| | | |
|---|---|---|
| *Drowning Bay* | B&W | 9 min. |
| | BFA Educational Media, Santa Monica, Calif. | |
| *Indians of California* | | |
| *Pt. 1 Village Life* | C | 15 Min. |
| *Pt. 2 Food* | C | 14 min. |
| | Barr Films, Pasadena, Calif. | |
| *Ishi in Two Worlds* | C | 19 min. |
| | McGraw-Hill Textfilms, New York, N.Y. | |
| *Loon's Necklace* | C | 11 min. |
| | Encyclopedia Brittanica | |
| | Educational Corp., Chicago, Ill. | |
| *Our Land Needs Your Help* | C | 13 min. |
| | Barr Films, Pasadena, Calif. | |
| *Urbanissimo* | C | 6 min. |
| | McGraw Hill Textfilms, New York, N.Y. | |

**Creative Expression**

| | | |
|---|---|---|
| *Nipomo, The Living Dunes* | C | 10 min. |
| | Sierra Club, San Francisco, Calif. | |
| *Paddle-to-the-Sea* | C | 8 min. |
| | Graphic Curriculum, Inc., New York, N.Y. | |
| *Rainshower* | C | 15 min. |
| | Churchill Films, Los Angeles, Calif. | |

| | | |
|---|---|---|
| *The Concession* | C | 17 min. |
| | out of print | |

**Life Sciences**

| | | |
|---|---|---|
| *Adaptations of Plants and Animals* | C | 14 min. |
| | Coronet Instructional Films, Chicago, Ill. | |
| *Bay Tidelands* | C | 15 min. |
| (Tripping with Terwilliger Series) | No information on distributor | |
| *Chaparral – The Elfin Forest* | C | 11 min. |
| | Barr Films, Pasadena, Calif. | |
| *Ecology I – The Sea Otter* | C | 17 min. |
| | Grover Productions, Monterey, Calif. | |
| *The Inter-Tidal Ecosystem* | C | 11 min. |
| (Ecological Systems - A Series) | Aims Instructional Materials, | |
| | Hollywood, Calif. | |
| *The Sea Otter* | C | 11 min. |
| | Barr Films, Pasadena, Calif. | |
| *Tide Pool Life* | B | 11 min. |
| | Simmel Meservey, Inc. | |
| | Los Angeles, Calif. | |
| *Water Birds* | C | 32 min. |
| | Walt Disney Productions, Inc. | |
| | Burbank, Calif. | |
| *What Ecologists Do* | C | 16 min. |
| | Centron Educational Films, | |
| | San Francisco, Calif. | |

## Student Reading List*

Nonfiction reading ordered by Dewey decimal number.

| *Number* | *Author* | *Title and Concept* |
|---|---|---|
| 338.1 | Helfman | *This Hungry World*<br>Use of natural resources, effects of over-population, world food. |
| 339 | Colby | *Fish and Wildlife*<br>Work of the U.S. Fish and Wildlife Service. |
| 339 | Fisher | *Wildlife in Danger*<br>Man and endangered species. |
| 339 | Green | *Wildlife in Danger*<br>Man and endangered species. |
| 339 | Hilton | *How Do They Cope With It?*<br>Man using nature's ways to cope with problems like fog, drought, earthquakes, etc. |
| 339 | Milne | *Cougar Doesn't Live Here Anymore*<br>Cougar as a vanishing species. |
| 339 | Smith | *First Book of Conservation*<br>Ways to save nature and renew it. |
| 339 | Van Dersal | *The Land Renewed*<br>The story of soil conservation |

*Adapted from the "Ecology List for Grades 4-6" from the Berkeley Public Library.

| | | |
|---|---|---|
| 500 | Busch | *City Lots; Living Things in Vacant Lots*<br>Environment of a vacant lot and the interdependence of life on it. |
| 507 | Creative Ed. Society | *Community of Living Things (5 volumes)*<br>1)Field and Meadow; 2)Fresh and Salt Water; 3)Parks and Gardens; 4)Forest and Woodland; 5)Desert. |
| 507 | Peattie | *Rainbow Book of Nature*<br>Joyous field trip to discover the secrets of sea, forest, meadow and stream. |
| 551 | Schneider | *Rocks, Rivers and Changing Earth*<br>Introduction to geology. |
| 570 | Darling | *Science of Life*<br>An attempt to explain life and adaptations and man's responsibility to use nature wisely. |
| 570 | Parker | *Balance of Nature*<br>Man trying to change his surroundings for himself instead of living in balance with nature and adapting to it. |
| 572 | Stoutenberg | *People in Twilight*<br>Effects of modern technology on the culture of primitive peoples. |
| 574 | Hirsch | *Living Community*<br>Ecology of interdependent organisms. |

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| 574.5 | Pond | *Survival in Sun and Sand*<br>How plants, animals and man must make adjustments to life in dry, hot places. |
| 574.5 | Stephen | *Nature's Way*<br>The web of nature – inter-relationships of all areas of nature. |
| 575 | Farb | *Story of Life*<br>Plants and animals and how they have survived through the ages. |
| 580 | Fenton | *Plants That Feed Us*<br>Plants that we eat. |
| 581 | Klien | *Discovering Plants*<br>A book of nature and science experiments using plants. |
| 581.6 | Selsam | *Plants that Heal*<br>Remedies from herbs. |
| 582 | Milne | *Because of a Tree*<br>Interdependence of trees, insects, plants and animals. |
| 590 | Laylock | *Never Pet a Porcupine*<br>Stories of the amazing habits of common, well-known animals and how they have adapted to life with man. |

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| 590 | Lorenz | *King Solomon's Ring*<br>A humorous, intimate but respectful discussion of animal ways and nature. |
| 590 | Ross | *City Critters*<br>How city animals and insects contribute to the ecological balance of a world of concrete and steel. |
| 590 | List | *Questions and Answers About Seashore Life*<br>Life in the intertidal areas. |
| 596 | Fisher | *Valley of the Smallest*<br>Day to day struggle for survival of a shrew and other small creatures, stressing interdependence. |
| 596 | McClung | *Shag: The Last of the Plains Buffalo*<br>The story of a vanishing species. |
| 596 | McCracken | *Caribou Traveler*<br>The story of the vanishing Arctic caribou as told through the life of Tutku and the migration of the herd. |
| 596 | Rue | *World of the White-tailed Deer*<br>A deer through all its seasons. |
| 596 | Van Wormer | *World of the Coyote*<br>Life-style and survival of the coyote community. |

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| 599 | McClung | *Thor, Last of the Sperm Whales*<br>Traces the life-cycle of a whale from birth to near-death. |
| 628 | Hilton | *How Do They Get Rid of It?*<br>Help! Before we are buried under piles of rubbish. Ways to make use of trash. |
| 628 | McCoy | *Shadows Over the Land*<br>Study of the pollution of air and water and what can be done about it. |
| 628.5 | Dwiggins | *Spaceship Earth*<br>A space look at our planet. |
| 636.1 | Henry | *Mustang*<br>True account of a woman's lifelong fight to save the wild mustangs from extinction. |
| 796 | Vinal | *Nature Recreation; Group Guidance for the Out-of-Doors*<br>Protection of nature as you enjoy it. |
| 796.5 | Harrison | *First Book of Hiking*<br>The commandments of safe, enjoyable hiking on city or wilderness trails. |
| 917 | Sanderson | *Continent We Live On*<br>Ecological discussion of North America. |

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| 920 | Kieran | *John James Audubon*<br>Biography of the famous naturalist. |
| 920 | Douglas | *Muir of the Mountains*<br>Biography of John Muir, famous naturalist. |
| 920 | Morrill | *John Muir, Protector of the Wilds*<br>Biography of John Muir. |

**Books Recommended for Teacher Use**


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California State Department of Fish and Game. *At the Crossroads: A Report on California's Endangered and Rare Fish and Wildlife.* Sacramento, Ca.: Resources Agency, 1971.

Harmon, M. et. al. *Clarifying Values Through Subject Matter: Applications for the Classroom.* New York: Winston Press, 1973.

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